

by turning the plates. By inclining the instrument to an angle of 23° to the west the bands disappeared. No difference could be observed between the Moon's disk and the corona. The polarimeter not being of a construction to localise a beam of light sufficiently.

General Remarks.

Protuberances were observed in three different places more in a cloudy form, as in the shape of horns at great prominences. Just before totality the whole sky had a leaden appearance. At the time of totality the blue patches in the sky appeared of a very deep purple colour, contrasting much with the rich brown appearance of the clouds.

The northern end of the crescent appeared like a string of pearls just before it was covered by the Moon.

On the Solar Eclipse of December 22, 1870, observed at Xerez in Spain. By R. Abbay, Esq.

The instrument with which my observations of the eclipse were made was a chemical spectroscop of two prisms of 45° each, kindly lent to me by Prof. C. A. Young, of Dartmouth, U.S. The diameters of the lenses of the collimator and telescope were $2\frac{1}{4}$ -inches each, and the focal lengths about 17 inches. The slit was about $\frac{1}{8}$ -inch in length (nearly one-half of it being covered by the prism used for reflecting the light from the vacuum tube into the collimator) and was placed in a horizontal position. There was a horizontal and vertical motion of the whole instrument, so that the collimator could be kept on the Sun without difficulty for almost any length of time. The angle of aperture of the collimator was about 7° , so that when directed to the Sun the light passing through the prisms was composed of that proceeding from all points within an angular radius of $3\frac{1}{2}^\circ$ from the Sun's centre, including, therefore, prominences, corona, and a portion of the sky surrounding them. A short time before totality began, I arranged the slit so that the D lines just appeared as a single thick line, this being the narrowest slit which it seemed safe to attempt to use, though I had determined to narrow the slit considerably if the bright lines appeared as bands on a continuous spectrum.

At 11.44, Xerez time, I noticed the B line extremely black. As totality approached the dark Fraunhofer lines slowly disappeared, leaving a dull spectrum, which also faded away immediately before three bright lines C D F (identified by means of the vacuum tube) made their appearance. These three lines came into view within two or three seconds after the shout announced that totality had begun, and they remained about 8 or 10 seconds.

C and D then disappeared, and two very sharp bright lines were seen, one coincident with the bright F line given by the vacuum tube, the other less refrangible than *b*. After some trouble I succeeded in placing the cross-wires very nearly on this bright line, and determined not to move the telescope during the rest of totality. No other lines appeared, although the C line of the vacuum tube was in the field on the one side and the F line on the other. I saw no continuous spectrum—the lines were bright on a dark ground. The F line was a little less bright than the other. On the reappearance of the dark lines after totality, I found that the cross-wires were on the vacant space between the lines 1464 and 1494 of Kirchhoff's scale. The measurement was as accurate as it was possible to obtain with the instrument used, and I cannot say with certainty that the bright line seen was absolutely coincident with the 1474 line. In order to give an idea of the dispersive power of the prisms, I may mention that after totality I tested the instrument by means of the light of the dull, heavy clouds which obscured everything, and found that I could not separate the D lines, but was able to obtain four thick lines like bands between E and *b*. I also saw 1464 and 1494 as single thick lines. By a rough calculation from the number of threads of the screw and the distance through which it was turned in bringing the jaws of the slit into contact, I came to the conclusion that it was from $\frac{1}{2}\frac{1}{50}$ -in. to $\frac{1}{2}\frac{1}{10}$ -in. wide. At the end of totality I noticed no reappearance of the bright lines C and D, nor do I remember at what moment the continuous spectrum came again into view. At about the middle of totality I looked up for a second or two at the corona; it appeared to the unaided eye to be distinctly and unevenly radiated. The light was of a pearly white, apparently of about the intensity of the full Moon, and extended to a distance of half or two-thirds of the diameter from the Sun. The shadows cast by certain parts of my instrument seemed as deep as those of a bright moonlight night, and the ivory handle of my commutator, which happened to be in shadow, was difficult to find.

The gradual disappearance of the Fraunhofer's lines as totality approached admits of two explanations. Either it was due to the general weakening of the light making it impossible to perceive these lines, or it was due to the superposition, on the spectrum with dark lines produced by the general light of the sky in the neighbourhood of the Sun, of a spectrum consisting mainly of bright lines proceeding from the extreme edge of the Sun's limb, this causing the Fraunhofer's lines to be more or less obliterated.

From the disappearance of the bright lines C and D some eight or ten seconds after the beginning of totality, I inferred that until the instant of their disappearance the chief part of the light passing through the prisms was due to the semicircle of the chromosphere, together with the prominences, visible chiefly on one limb. After this, and during the central period of totality, the main portion of the light was given by that part of the envelope

of the Sun which is above the red flames (whether chromosphere or corona). It is possible the green line, which was the stronger, may be due to some substance in the highest portion of this envelope; and the F line, which continued during the whole of totality, to moderately cool hydrogen somewhat nearer to the Sun's surface. It is clear that the same spectrum will be obtained, during the middle of totality, from light proceeding from points anywhere apparently in the neighbourhood of the Sun, and even from that reflected from clouds, as the whole atmosphere is then illuminated by light of this peculiar kind, so that the spectroscope does not appear to me capable of giving any conclusive evidence as to the extent of this luminous envelope.

Oxford, Jan. 13th, 1871.

Solar Eclipse, Dec. 22, 1870. By William Stainer, Navigating Sub.-Lieut. H.M. Gunboat Pigeon.

Went on shore to visit the astronomers, and was fortunate enough to observe the eclipse of the Sun during its totality with a $2\frac{3}{4}$ -inch inverting telescope belonging to Mr. James Buckingham, C.E. I distinctly saw a rim of light around the dark body of the Sun, extending to about $\frac{1}{30}$ th of the Sun's diameter from the edge. I also saw three permanent shoots of light extending about $\frac{1}{10}$ th of the Sun's diameter from the Sun's edge; one on the N.E., one on the S.E., and one on the S.W., besides several smaller ones between, they were reddish, close to the edge, and yellowish towards the extremity. The diameter of the rays of light was about $\frac{1}{3}$ rd of their length; the interval that elapsed during the visibility of the corona was from five to ten seconds. *Saturn* I also observed distinctly below the Sun at a distance of twice its diameter. The telescope through which I made the observations was the finder of Mr. James Buckingham's large 9-inch telescope for photographing the corona; the Sun being kept directly on the cross-wires of the telescope by clockwork.

The Spanish observers, including the Astronomer Royal of Madrid, who were about a mile distant, saw nothing whatever of the corona during the Sun's totality, which at this place was $2^m 9^s$.

Solar Eclipse, December 22, 1870, observed at San Antonio, near Puerto de Sta. Maria. By the Rev. S. J. Perry.

Being prevented by a course of lectures, and by pressing observatory work, from attending the January meeting of the